EARTHSTREAM

Earthstream® for Supply Chain Intelligence

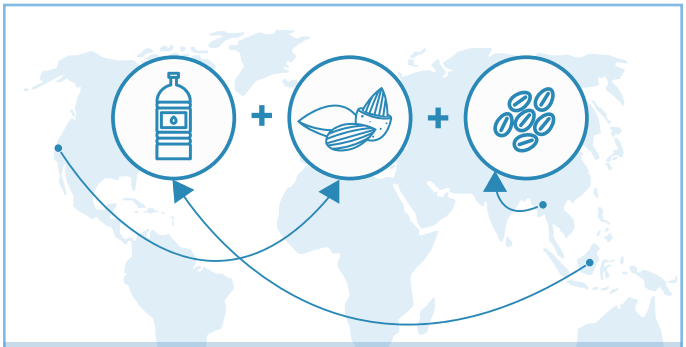
Building organizational capabilities to turn supply chain risk into a strategic advantage

World economic growth has hinged on rapid industrialization, modernization, and technological advancement.

A defining characteristic has been increasingly more complex supply chains that connect producers with consumers. The role of management has been to deliver better products, more quickly, and more cost-effectively within the constraints imposed by nature, business operating models, and the whims of fickle consumers.

For example, the snack bar you enjoy may contain palm kernel oil, from equatorial Indonesia, almonds from California's Central Valley, and sesame seeds from Myanmar, to name just a few ingredients. These all need to come together, be manufactured and packaged, and then distributed to the retail store for you to buy. The supply chain for simple consumer electronics products like a solid state external hard drive can be orders of magnitude more complex.

Supply chain management (SCM) is the name of the management practice that brings together academic research, management techniques, experiences, and technology, that over the last several decades, has been able to increase variety and abundance while reducing the costs and lead-times, of the things we buy, fueling world economic growth.



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However, despite incredible advancements in the art of supply chain management, our supply chains have always been vulnerable. It is fashionable to point to the impact of the recent COVID-19 pandemic as an example of the fragility of our supply chains. That thesis has quickly been replaced with the more recent Russian invasion of Ukraine. In fact, whether it's natural disasters (volcano

> "The global supply chain is deeply intertwined in most nations' national or public safety, including that of the United States."
>
> —Hetherington Group - *Intelligence Risks in 2022: The Supply Chain*

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eruption in Europe, hurricane Katrina) or man-made disasters (Fukushima nuclear disaster, Ever Given running aground in the Suez Canal) supply chain disruptions have always been with us. Only now, the risks and impacts are more serious, as the world becomes increasingly more connected. It has been argued that supply chain optimization, aided by containerization and modern communications, has chased low-cost labor, at the expense of resiliency.

What SCM has delivered is an unmanageably complex system that is fragile and subject to frequent disruptions. Risk is an inherent feature of our supply chains that can't be "managed" away. Management practices are inherently defensive in nature, but business is after all, about taking risks. What is required is a recognition of the opportunities presented by the complexity of the system and the development of offensive strategies grounded in sound intelligence.

American financial executive, author, and Columbia University professor, Leo Tilman, defined risk intelligence as "The organizational ability to think holistically about risk and uncertainty, speak a common risk language, and effectively use forward-looking risk concepts and tools in making better decisions, alleviating threats, capitalizing on opportunities, and creating lasting value."

The Earthstream® platform by Mesur.io is the tool decision makers use to holistically

Deforested area near Porto Velho, Brazil. Ilegal airstrips are bringing toxic mining to Brazil's indigenous land
PHOTO BY BRUNO KELLY / AMAZONIA REAL

think about supply chain risk, make informed decisions, capitalize on gaps, and create a competitive advantage for their companies, customers, and shareholders.

Broadly speaking, supply chain risk is often categorized as either Internal Risk, the risk inherent in operations you manage, and External Risk, which is risk coming from outside your organization. Once a raw material has entered your factory, the internal supply chain risks are more easily quantified. It's the external risks posed by economic, geopolitical, environmental, regulatory, and social media that are much harder to quantify and manage.

As the name suggests, Earthstream is particularly adept at identifying risk at the intersection of human activity and the environment. Earthstream tackles the most opaque part of the supply chain, external risk, and provides risk intelligence. Our machine learning models combine satellite, demographic and economic, transactional, social, news, media, and academic content to build agronomic and domain-specific predictions that inform decision-makers of the potential risk to their supply chains.

The first core tenet of good intelligence is observability or visibility. The second is predicting possible outcomes, based on those observations, or simulations.

The more you can see, the lower the risk of disruption, or more likely an opportunity in the market might be spotted. A common approach to increase supply chain visibility, reduce costs, and increase control over the supply and quality of raw materials is vertical integration. Vertical integration is a business strategy to acquire business operations upstream and downstream in the supply chain. Essentially risk is reduced by converting what was an external risk into an internal risk by extending the management of supply chain operations.

Vertical integration, however, has its limits. Even the most acclaimed examples experience disruptions due to external factors which remain elusively invisible to

SUPPLY CHAIN VISIBILITY:
PALM OIL PRODUCTION

76% of companies report having a traceability system for at least one commodity—but most companies have significant gaps in supply chain traceability, necessary to assess and manage deforestation and conversion risk

23% of reporting companies can trace more than 90% of the volumes they produce or source back to the region for at least one commodity.

38% of companies report having no origin information for at least half of their commodity volumes

28% report having no traceability system for at least one that they source

Source: Accountability Framework survey results on achieving deforestation-free supply chains

management. For example, a global beer producer can acquire the hops plantations and perhaps even their own bottling plants but are unlikely to acquire the fertilizer manufacturing plant to produce high yields for their hops or the mining operations for silica and limestone, the ingredients in glass bottles. A disruption in the supply of fertilizer or silica can bring the entire operation to a halt. However, there are practical limits to the extent of complete vertical integration, chief among them being costs associated with diminishing economies of scale and the increased complexity to integrate beyond the raw material commodity.

While end-to-end operational integration is impractical, it is possible to digitally connect all upstream and downstream supply chain activities and model them virtually, creating

Vertical vs. Horizontal Integration, Explained

HORIZONTAL	vs	VERTICAL
Expansion is to similar operations		Expansion is to different operations within the supply chain
Aims to increase the business		Aims to strengthen the supply chain
Aims to increase market share		Aims to reduce waste and cost
Flexibility over efficiency		Efficiency over flexibility

Both horizontal and vertical integration are valid business strategies. **Horizontal integration** refers to expansion of business operations by expanding to the same level of the supply chain within the same industry. **Vertical integration** is the expansion of business operations upstream and downstream in the supply chain, thus covering more parts of it.

EARTHSTREAM

Dysprosium (Dy)

Dysprosium is a Rare Earth Element (REE) mainly used in the manufacturing of permanent magnets, which are an essential component required to produce modern technology.

China dominates dysprosium extraction and refining, creating a strategic advantage and contributing to the establishment of the metal as a critical material for both the United States and the European Union. Myanmar is also a major source of dysprosium, which creates a supply chain resilience risk due to that country's continuing political crisis.

https://www.material-insights.org/materials/dysprosium/

a digital twin of a fully vertically integrated supply chain. This digital twin can then be used to observe and simulate future possible scenarios, providing the necessary supply chain risk intelligence to decision makers. It also allows organizations who have strategically decided to outsource portions of their supply chain to contract manufacturers and 3rd party logistics (3PL), so that they can focus on their core competencies, to effectively manage their supply chain as if it were entirely vertically integrated.

Earthstream automatically identifies, cleans, and links all data, extracting critical information from large natural language and image sets. It builds self-learning models that synthesize the data and predict possible future scenarios and suggest sustainable solutions and alternative sourcing options.

Our technical focus has been on modeling activities associated with raw material origination because this is typically the most difficult part of the supply chain. Whether it be agricultural production, including food, forestry, and natural fibers for textiles, or mining, including critical minerals upon which our modern way of life depends, Earthstream offers an AI-powered solution to supply chain risk intelligence.

The Earthstream autoML platform by mesur.io provides rapid insight into some of the biggest challenges facing your supply chain, the planet, and humanity. Our proprietary machine-learning models have delivered proven results for government agencies, policymakers, and Fortune 500 corporations.

If you would like a demonstration of our capabilities contact us at sales@mesur.io. We look forward to putting Earthstream to work for you.